PATENT ABSTRACTS OF JAPAN

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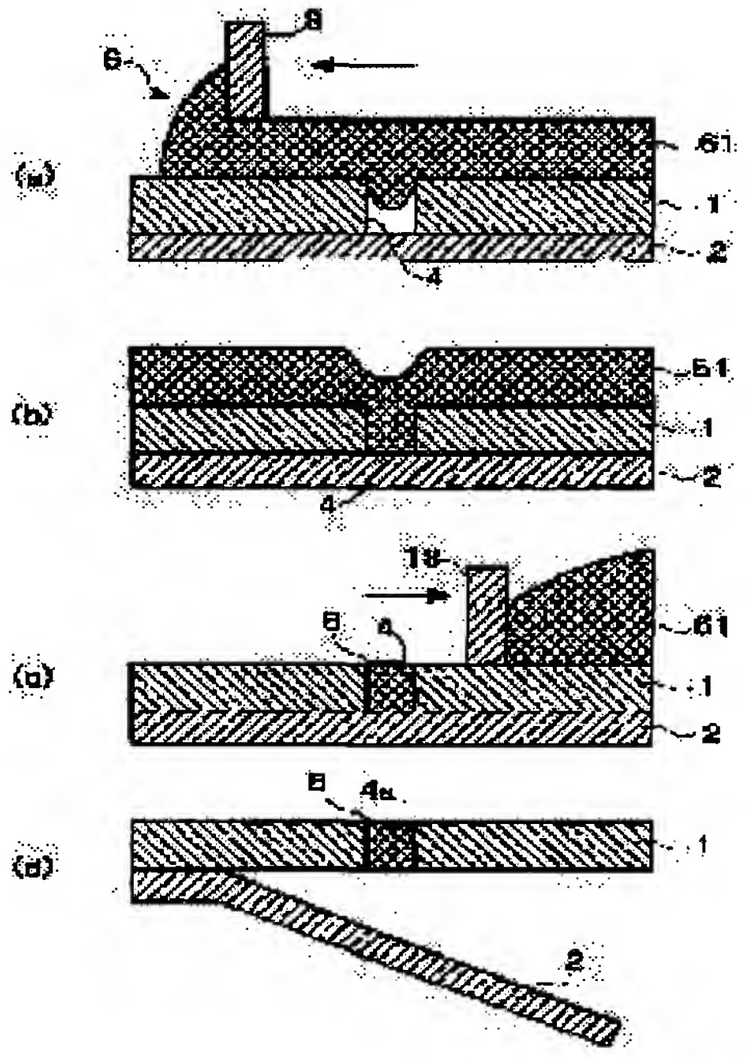
(54) METHOD OF MANUFACTURING RESIN-SEALED SUBSTRATE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a method by which a resin-sealed substrate having a through hole sufficiently filled up with a sealing resin can be manufactured.
SOLUTION: This method of manufacturing resin-sealed substrate includes a not penetrated hole forming step of forming a not penetrated hole 4 having a closed bottom in the substrate 1, a squeegee operation step (a) of filling up the not penetrated hole 4 with the sealing resin 6 by pushing the resin 6 into the hole 4 while an oversupplied layer 61 of the resin 6 is formed on the substrate 1 in a layer-like shape by operating a squeegee 8 under a vacuum atmosphere, and an air-pressure-difference packing step (b) of packing the resin 6 into the not penetrated hole 4 by pushing part of the oversupplied layer 61 into the hole 4 by using an air pressure difference by raising the pressure in the vacuum atmosphere toward the atmospheric pressure. This method also includes an excessive resin removing step (c) of removing the oversupplied layer 61 left on the surface 1 after the step (b) from the substrate 1 and a through hole forming step (d) of forming the through hole 4a by removing the bottom section of the hole 4. The thickness of the oversupplied layer 61 is set so that the volume decrease of the layer 61 caused by the air-pressure- difference packing may does not exceed the thickness range of the layer 61.



CLAIMS

[Claim(s)]
[Claim 1]It is a manufacturing method of a resin sealed substrate which carries out the resin seal of the breakthrough formed in a substrate, Operating a squeegee under a closed-end hole formation process which forms in a substrate a closed-end hole by which a lower end opening part was closed, and a vacuum atmosphere, and forming an oversupply layer of sealing resin in layers on a substrate. By turning to atmospheric pressure a squeegee operation process and ambient pressure power which push in said sealing resin in said closed-end hole, and are filled up with it, and raising them, As an air pressure difference packer who pushes in said a part of oversupply layer in said closed-end hole according to air pressure difference, and is filled up with it, An excess resin removal process which removes said oversupply layer which remains at the back like said air pressure difference packer from said substrate, And a manufacturing method of a resin sealed substrate setting up said thickness so that ****** of said oversupply layer which is provided with a through-hole formation process which removes a pars basilaris ossis occipitalis of said closed-end hole, and is made into a breakthrough, and is produced by air pressure difference restoration may become within the limits of thickness of this oversupply layer.
[Claim 2]A manufacturing method of the resin sealed substrate according to claim 1, wherein viscosity of said sealing resin is below 200 Pa and s in 23 **.
[Claim 3]It is a manufacturing method of a resin sealed substrate which carries out the resin seal of the breakthrough formed in a substrate, By operating a squeegee under a closed-end hole formation process which forms in a substrate a closed-end hole by which a lower end opening part was closed, and a vacuum atmosphere, and raising the 1st squeegee operation process and ambient pressure power which push in sealing resin in said closed-end hole, and are filled up with it, As the 1st air pressure difference packer which pushes in sealing resin in said closed-end hole according to air pressure difference, and is filled up with it, Reduce ambient pressure power and a squeegee is operated under a vacuum atmosphere, The 2nd squeegee operation process that pushes in and fills up with sealing resin upper space of said closed-end hole produced like said 1st air pressure difference packer, A manufacturing method of a resin sealed substrate provided with a through-hole formation process which raises ambient pressure power, removes a pars basilaris ossis occipitalis of said closed-end hole after resin filling ending into said closed-end hole like the 2nd air pressure difference packer which pushes in further sealing resin in said closed-end hole according to air pressure difference, and is filled up with it, and is made into a breakthrough.
[Claim 4]A manufacturing method of the resin sealed substrate according to claim 3 performing said through-hole formation process after repeating like the 2nd squeegee operation process and the 2nd air pressure difference packer two or more times and performing it.
[Claim 5]A manufacturing method of the resin sealed substrate according to claim 3 or 4, wherein viscosity of said sealing resin is larger than 200 Pa-s in 23 **.
[Claim 6]A manufacturing method of the resin sealed substrate according to any one of claims 3 to 5, wherein a climbing speed of ambient pressure power of setting it like the 2nd air pressure difference packer as said 1st air pressure difference packer is a part for 10 - 50kPa/.
[Claim 7]A manufacturing method of the resin sealed substrate according to any one of claims 3 to 6 setting up more highly than ambient pressure power in said 1st squeegee operation process ambient pressure power in said 2nd squeegee operation process.
[Claim 8]By the time it is the same as ambient pressure power in said 1st squeegee operation process, or it sets up lower than it ambient pressure power in said 2nd squeegee operation process and it starts said 2nd squeegee operation process the back like said air pressure difference packer of ** a 1st, A manufacturing method of the resin sealed substrate according to any one of claims 3 to 7 characterized by a predetermined thing to do for time neglect.
[Claim 9]A manufacturing method of the resin sealed substrate according to any one of claims 1 to 8 with which said closed-end hole formation process is further provided with a process of forming a resin protective film in the surface of said substrate, and said through-hole formation process is further provided with a process of removing said resin protective film from said substrate.
[Claim 10]A manufacturing method of the resin sealed substrate according to any one of claims 1 to 9 further provided with a process of making sealing resin with which said breakthrough is filled up by etching the rear-face side of said substrate after said through-hole formation process removes a pars basilaris ossis occipitalis of said closed-end hole and makes it a breakthrough projecting.

[Translation done.]

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TECHNICAL FIELD

[Field of the Invention]This invention relates to the manufacturing method of the resin sealed substrate which carries out the resin seal of the breakthrough formed in substrates, such as a semiconductor substrate.

[Translation done.]

PRIOR ART

[Description of the Prior Art]The miniaturization and slimming down of the semiconductor device which are used are attained with a miniaturization and slimming down of electronic equipment. For example, development of the package directly carried in a mother board per element like what packed via the interposer like a BGA package or CSP, a flip chip package, or a wafer level package is performed.
[0003]Since the reduction of such package size is approaching the limit on the two-dimensional level, when it laminates two or more elements arranged planate in three dimensions these days, development of the art in which one package attains two or more functions by space-saving is furthered. Since reduction of package size cannot be attained as the technique of connecting between the circuits of each laminated element when based on wirebonding, A breakthrough is formed in a semiconductor substrate instead of using a wire, and the trial which carries out reduction of the package attracts attention by having composition which makes it flow through an up-and-down circuit via this breakthrough.
[0004]The method which insulates the wall surface of a breakthrough and is filled up with conductive resin in a breakthrough as a method of making it flowing through the rear surface of a semiconductor substrate, and the method of carrying out electric conduction plating of the wall surface of a breakthrough, and filling up the inside of a breakthrough with resin for heat dissipation are mentioned. Since in the case of the former reliability will fall if a resin non-filling part exists in a breakthrough, the inside of a breakthrough must be thoroughly filled with resin. Even if a resin non-filling part exists in a breakthrough in the case of the latter, defective continuity's problem is not produced, but in order to make good diffusion of generation of heat accompanying the drive of an element, it is preferred that the inside of a breakthrough is too filled with resin thoroughly. namely, -- to the sealing resin with which the breakthrough of a semiconductor substrate is filled up, air bubbles are hardly included in an inside -- and the surface of a substrate -- abbreviated -- a flat-tapped thing is required.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention]According to this invention, the resin sealed substrate with which sealing resin was fully filled up into the breakthrough formed in the substrate can be manufactured so that clearly from the above explanation.

[Translation done.]

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]As a method of carrying out the resin seal of the breakthrough formed in the semiconductor substrate, as shown in drawing 4 (a), the method which stuffs into the breakthrough 56 the resin 54 which slid the squeegee 50 along the surface of the substrate 52, and was supplied, and is filled up with it is common. However, since the circuit pattern is very detailed, to be a minute diameter is demanded, for example, in a general wiring board, the breakthroughs formed in the semiconductor substrate are several micrometers - 10 micrometers of numbers to the diameter of a through hole being several 100 micrometers. For this reason, the squeegee was only operated and the following problems had arisen only by being pushed in and filled up.
[0006]That is, when the viscosity of resin was low, as shown in drawing 4 (b), the resin supplied to the breakthrough 56 oozed from the lower part of the substrate 52, before hardening, and there was a possibility of producing the non-filling part 56a near the upper opening of the breakthrough 56. Such a phenomenon is not restricted to resin with low viscosity in ordinary temperature, but, in the case of the resin which carries out a viscosity down at the temperature at the time of hardening, may be produced. On the other hand, when the viscosity of resin was high, as shown in drawing 4 (c), there was a problem that it was difficult to the lower part of the breakthrough 56 to fully push in the resin 54, and the non-filling part 56a will exist in the breakthrough 56.
[0007]The problem that a possibility of remaining as air bubbles was in resin after closure also had the air involved in when the breakthrough 56 was filled up in addition to the problem mentioned above.
[0008]*This invention was made that such a problem should be solved and is ****. The purpose is to provide the manufacturing method of a resin* sealed substrate with which the formed breakthrough was fully filled up with sealing resin.

[Translation done.]

MEANS

[Means for Solving the Problem]Said purpose of this invention is a manufacturing method of a resin sealed substrate which carries out the resin seal of the breakthrough formed in a substrate, Operating a squeegee under a closed-end hole formation process which forms in a substrate a closed-end hole by which a lower end opening part was closed, and a vacuum atmosphere, and forming an oversupply layer of sealing resin in layers on a substrate. By turning to atmospheric pressure a squeegee operation process and ambient pressure power which push in said sealing resin in said closed-end hole, and are filled up with it, and raising them, As an air pressure difference packer who pushes in said a part of oversupply layer in said closed-end hole according to air pressure difference, and is filled up with it, An excess resin removal process which removes said oversupply layer which remains at the back like said air pressure difference packer from said substrate, And it has a through-hole formation process which removes a pars basilaris ossis occipitalis of said closed-end hole, and is made into a breakthrough, and is attained by a manufacturing method of a resin sealed substrate setting up said thickness so that ****** of said oversupply layer produced by air pressure difference restoration may become within the limits of thickness of this oversupply layer.
[0010]In below 200 Pa and s, viscosity of said sealing resin is preferred for especially a manufacturing method of this resin sealed substrate in 23 **.
[0011]Said purpose of this invention is a manufacturing method of a resin sealed substrate which carries out the resin seal of the breakthrough formed in a substrate, By operating a squeegee under a closed-end hole formation process which forms in a substrate a closed-end hole by which a lower end opening part was closed, and a vacuum atmosphere, and raising the 1st squeegee operation process and ambient pressure power which push in sealing resin in said closed-end hole, and are filled up with it, As the 1st air pressure difference packer which pushes in sealing resin in said closed-end hole according to air pressure difference, and is filled up with it, Reduce ambient pressure power and a squeegee is operated under a vacuum atmosphere, The 2nd squeegee operation process that pushes in and fills up with sealing resin upper space of said closed-end hole produced like said 1st air pressure difference packer, As the 2nd air pressure difference packer which raises ambient pressure power, pushes in further sealing resin in said closed-end hole according to air pressure difference, and is filled up with it, And after resin filling ending into said closed-end hole, it is attained also by a manufacturing method of a resin sealed substrate provided with a through-hole formation process which removes a pars basilaris ossis occipitalis of said closed-end hole, and is made into a breakthrough.
[0012]As for a manufacturing method of this resin sealed substrate, it is preferred to perform said through-hole formation process if needed, after repeating like the 2nd squeegee operation process and the 2nd air pressure difference packer two or more times and performing it.
[0013]In 23 **, viscosity of said sealing resin is especially preferred, when larger than 200 Pa-s.
[0014]As for a climbing speed of ambient pressure power of setting it like the 2nd air pressure difference packer as said 1st air pressure difference packer, it is preferred that it is a part for 10 - 50kPa/.
[0015]ambient pressure power in said 2nd squeegee operation process being set up more highly than ambient pressure power in said 1st squeegee operation process, or, until it is the same as ambient pressure power in said 1st squeegee operation process, or it sets up lower than it ambient pressure power in said 2nd squeegee operation process and it starts said 2nd squeegee operation process the back like said air pressure difference packer of ** a 1st -- predetermined time neglect -- it may be made to carry out.
[0016]In these manufacturing methods of a resin sealed substrate, said closed-end hole formation process may be further provided with a process of forming a resin protective film in the surface of said substrate, and said through-hole formation process may be further provided with a process of removing said resin protective film from said substrate.
[0017]After said through-hole formation process removes a pars basilaris ossis occipitalis of said closed-end hole and makes it a breakthrough, it may be further provided with a process of making sealing resin with which said breakthrough is filled up projecting, by etching the rear-face side of said substrate.
[0018]
[Embodiment of the Invention]Hereafter, the actual condition gestalt of this invention is explained with reference to an accompanying drawing.
[0019](A 1st embodiment) Drawing 1 is process drawing showing the manufacturing method of the resin sealed substrate concerning a 1st embodiment of this invention.
[0020]First, as shown in drawing 1 (a), the adhesive tape 2 of easy-releasability is stuck on the rear-face side of the substrate 1, after using as the closed-end hole 4 the breakthrough formed in the substrate 1, the resin 6 is supplied to the surface of the substrate 1, and the squeegee 8 is operated under a vacuum atmosphere. As for ambient pressure power, it is preferred to set it as 0.013 - 2.67kPa, and it is more preferred to set it as 0.067 - 1.33kPa. When ambient pressure power is too high, while becoming difficult to acquire the effect of the air pressure difference restoration mentioned later air bubbles' not only remaining easily to resin, but, when ambient pressure power is too low, it takes time to make it return to atmospheric pressure, and is in the tendency for productive efficiency to fall.
[0021]When height adjustment is performed so that only predetermined height may be located up from the surface of the substrate 1, and the squeegee 8 operates the squeegee 8 by this, the oversupply layer 61 of the resin 6 is formed in the surface of the substrate 1 in layers. It can come, simultaneously the resin 6 is stuffed into the closed-end hole 4.
[0022]As the resin 6, thermosetting resin, such as an epoxy resin, an acrylic resin, polyimide resin, and silicone resin, is used suitably, and liquid epoxy resin of hypoviscosity is preferred especially in respect of a price, workability, and the characteristic. When the wall surface of the closed-end hole 4 is insulation, it is preferred to have conductivity, but when the wall surface of the closed-end hole 4 is plated with metal (copper, nickel, gold, etc.) and the rear surface flow is taken, conductivity is not necessarily required. However, even if it is when conductivity is unnecessary, it is the purpose of radiating generation of heat accompanying the drive of an element, and it is effective to use the resin which blended metal powder (for example, copper, silver, aluminum, gold, etc.). In this case, it is the purpose to improve thermal conductivity, and in order that necessity may not carry out conductivity, combination of an about [30-70wt%] may be sufficient. Of course, it is also possible to raise the content of metal powder and to give conductivity.
[0023]It is the purpose of improving heat dissipation nature, and what blended thermally conductive high bulking agents (for example, silica, alumina, alumimium nitride, silicon nitride, boron nitride, other metallic oxides, etc.) is effective instead of blending metal powder. In the case of the resin 6 which blended such a filler, since the coefficient of thermal expansion of resin can be reduced and it can bring close to the coefficient of thermal expansion of the substrate (semiconductor substrate) 1, it is effective in reliability being improved.
[0024]As for the viscosity of the resin 6 used by this embodiment, in 23 **, it is preferred that it is below 200 Pa and s. The diluent of hypoviscosity can be used, when the viscosity of the resin 6 increases and workability needs to be improved by combination of a conductive material or a bulking agent. However, it is necessary to choose a diluent which does not cause presentation change of boil, volatilization, etc. with the degree of vacuum at the time of printing under the conditions printed under a vacuum. For example, an acrylic monomer, a styrene monomer,

a silicone coupling agent, silicone oil, etc. besides the solvent of a high boiling point and the epoxy resin (monoepoxy, the diepoxy compound which are called reactive diluent) of hypoviscosity are preferred as a diluent.
[0025]As shown in drawing 1 (a), the resin 6 is supplied to the closed-end hole 4 by the squeegee operation process under such a vacuum atmosphere, but will be existed in the lower part of the closed-end hole 4 by the non-filling part 14.
[0026]Next, ambient pressure power is turned to atmospheric pressure, and is raised. As air pressure difference arises between the non-filling part 14 and an external atmosphere and it is shown in drawing 1 (b) like this air pressure difference packer, a part of oversupply layer 61 is pushed in towards the non-filling part 14, and will be become depressed by the surface of the oversupply layer 61.
[0027]Then, as shown in drawing 1 (c), the oversupply layer 61 which performs an excess resin removal process and remains the scraping member 18 sliding or by carrying out moved close along the surface of the substrate 1 under atmospheric pressure is removed, and the surface of the resin with which the closed-end hole 4 was filled up is made smooth.
[0028]And since resin in the closed-end hole 4 is stiffened, by exfoliating the adhesive tape 2, as shown in drawing 1 (d), a closed-end hole turns into the breakthrough 4a, and a resin sealed substrate is completed.
[0029]According to the resin sealed substrate manufactured in this way, since a squeegee operation process is performed under a vacuum atmosphere, it can prevent air bubbles remaining to the resin supplied to the closed-end hole 4. Since the resin supplied to the closed-end hole 4 can be set like an air pressure difference packer and can be pushed in further, even if the closed-end hole 4 is a minute diameter, restoration sufficient to the deepest part is possible. Although ****** arises to resin of closed-end hole 4 inside and the hollow of the oversupply layer 61 is formed like this air pressure difference packer, By setting up the thickness of the oversupply layer 61 beforehand become larger than this hollow depth, resin of sufficient quantity for the inside of the closed-end hole 4 can be supplied, and the non-filling part 14 can be extinguished. These results can obtain the resin sealed substrate with which sealing resin was fully filled up into the breakthrough formed in the substrate.
[0030]The manufacturing method of the resin sealed substrate concerning (a 2nd embodiment), next a 2nd embodiment of this invention is explained based on process drawing shown in drawing 2. In explanation of this embodiment, the same numerals are attached about the same composition as a 1st embodiment.
[0031]First, as shown in drawing 2 (a), the adhesive tape 2 of easy-releasability is stuck on the rear-face side of the substrate 1, after using as the closed-end hole 4 the breakthrough formed in the substrate 1, the resin 6 is supplied to the surface side of the substrate 1, and the squeegee 8 is operated under a vacuum atmosphere. Since ambient pressure power is the same as that of the case of a 1st embodiment, it is preferred to set it as 0.013 - 2.67kPa, and it is more preferred to set it as 0.067 - 1.33kPa.
[0032]the squeegee 8 meets the surface of the substrate 1 -- sliding -- or height adjustment is performed so that moved close may be carried out. Thereby, the resin 6 is stuffed into the closed-end hole 4, and the remaining resin 6 is scratched with movement of the squeegee 8.
[0033]Although it is usable, what was mentioned in a 1st embodiment as the resin 6, The manufacturing method of the resin sealed substrate concerning a 1st embodiment, To the viscosity at 23 ** being preferred when [of 200 or less Pa-s] using resin of hypoviscosity comparatively, the manufacturing method concerning this embodiment can be especially used preferably, when the viscosity of the resin to be used exceeds 200 Pa-s in 23 **. However, even when using the resin 6 of hypoviscosity, it is possible to manufacture a resin sealed substrate with the manufacturing method of this embodiment.
[0034]As shown in drawing 2 (a), the resin 6 is supplied to the closed-end hole 4 by the 1st squeegee operation process under such a vacuum atmosphere, but will be existed in the lower part of the closed-end hole 4 by the non-filling part 14.
[0035]Next, ambient pressure power is turned to atmospheric pressure, and is raised. As air pressure difference arises between the non-filling part 14 and an external atmosphere and it is shown in drawing 2 (b) like this 1st air pressure difference packer, the resin 6 supplied to the closed-end part 4 is pushed in to the deepest part. Thereby, the non-filling part 14 moves to the upper part of the closed-end hole 4. As for the final ambient pressure power of setting like the 1st air pressure difference packer, it is preferred that they are 2.67kPa - 101.3kPa (atmospheric pressure), and it is more preferred that they are 13.3kPa - 101.3kPa (atmospheric pressure).
[0036]Subsequently, after reducing ambient pressure power again and raising a degree of vacuum, as shown in drawing 2 (c), the resin 6 is again supplied to the surface of the substrate 1, the squeegee 8 is operated under a vacuum atmosphere, and the 2nd squeegee operation process is performed. As for the ambient pressure power at this time, it is preferred to set it as the same range as the ambient pressure power in the 1st squeegee operation process. Thereby, the resin 6 is supplied to the non-filling part 14.
[0037]Then, turn ambient pressure power to atmospheric pressure, and it is made to go up again, and carries out like the 2nd air pressure difference packer. Thereby, as shown in drawing 2 (d), the resin 6 supplied to the closed-end hole 4 at the 2nd squeegee operation process is pushed in. It is preferred to set it as the range same also about the final ambient pressure power of setting like the 2nd air pressure difference packer as the ambient pressure power of setting like the 1st air pressure difference packer.
[0038]When a hollow is seen in the upper part of the resin 6 supplied to the closed-end hole 4 even after carrying out like the 2nd air pressure difference packer, it is preferred to carry out like the 2nd squeegee operation process mentioned above and the 2nd air pressure difference packer repeatedly until this hollow is reduced to the size which does not pose a problem substantially. This repeat frequency can be suitably set up in consideration of the path and the depth of the closed-end hole 4, or the viscosity of the resin 6.
[0039]Like a 1st embodiment, after finishing the resin filling to the closed-end hole 4, since the resin 6 in the closed-end hole 4 is stiffened, by exfoliating the adhesive tape 2, the closed-end hole 4 turns into a breakthrough, and a resin sealed substrate is completed.
[0040]According to the resin sealed substrate manufactured in this way, since the 1st and 2nd squeegee operation processes are performed under a vacuum atmosphere, it can prevent air bubbles remaining to the resin supplied to the closed-end hole 4. After pushing in the resin 6 supplied to the closed-end hole 4 at the 1st squeegee operation process like the 1st air pressure difference packer, Since he is trying to push in the resin 6 supplied to the closed-end hole 4 at the 2nd squeegee operation process like the 2nd air pressure difference packer, the closed-end hole 4 can be supplied without making the non-filling part 14 remain, even if it is the resin 6 with high viscosity. These results can obtain the resin sealed substrate with which sealing resin was fully filled up into the breakthrough formed in the substrate.
[0041]As for the pressure-buildup speed at the time of setting like the 1st and 2nd air pressure difference packers, and raising ambient pressure power, it is preferred to set it as a part for 10 - 50kPa/. Since the resin 6 currently supplied to the closed-end hole 4 will be quickly pushed in if a pressure buildup is too rapid, while a non-filling part remains easily to the resin 6 pushed in to the deepest part, when a pressure buildup is too loose, it is because it is in the tendency for productive efficiency to fall.
[0042]It is preferred to set up more highly (namely, a degree of vacuum low) than the ambient pressure power in the 1st squeegee operation process the ambient pressure power in the 2nd squeegee operation process from a viewpoint of raising productive efficiency. Since the pushing quantity of the resin 6 demanded in the 2nd squeegee operation process is smaller than the pushing quantity demanded in the 1st squeegee operation process, even if it sets up ambient pressure power in this way, it can fully stuff the resin 6 into the closed-end hole 4. By such setting out, the time which the 2nd squeegee operation process takes can be shortened, There is no possibility that it may be generated by the detailed air bubbles of the grade which does not pose a problem from the resin 6 supplied to the closed-end hole 4 like the 1st air pressure difference packer practically, and stabilization of the resin shape in the closed-end hole 4 can be attained. What is necessary is just to set up as a post process so that ambient pressure power may become high in carrying out by repeating the 2nd squeegee operation process.
[0043]On the other hand, it is preferred for it to be the same as the ambient pressure power in the 1st squeegee operation process, or to set up lower (namely, a degree of vacuum highly) than this the ambient pressure power in the 2nd squeegee operation process from a viewpoint of improving the reliability of a resin seal. Even if it is a case where air bubbles remain by this to the resin 6 stuffed into the closed-end hole 4 like the 1st air pressure difference packer, defoaming becomes possible, and it can be filled up with more perfect sealing resin. In order to ensure such defoaming, before starting the 2nd squeegee operation process, it is [the back like the air pressure difference packer of ** a 1st] preferred to carry out predetermined time (for example, 1 to 10 minutes) neglect. What is necessary is just to set up as a post process so that each ambient

pressure power may similarly be set up or ambient pressure power may become low in carrying out by repeating the 2nd squeegee operation process.

[0044](Other embodiments) Although one embodiment of this invention was explained in full detail above, the concrete mode of this invention is not limited to the above-mentioned embodiment. For example, when stiffening the thermosetting resin 6 supplied to the closed-end hole 4 in each above-mentioned embodiment, ambient pressure power is made into the pressure (for example, 0.1 - 5MPa) more than atmospheric pressure, By heating about 10 to 120 minutes at a predetermined temperature (for example, 60-200 **), the resin 6 can be stiffened in a short time, and shortening of a process can be attained.

[0045]In each above-mentioned embodiment, before supplying the resin 6 to the substrate 1, as shown in drawing 3 (a), the resin protective film 21 may be beforehand formed in the surface of the substrate 1. As the opening is formed in the portion corresponding to the breakthrough of the substrate 1 and this resin protective film 21 is shown in drawing 3 (b) after the resin curing in [after resin supply ending to the closed-end hole 4] the closed-end hole 4, By removing the resin protective film 21, a possibility that the supplied resin 6 for closure may remain on the surface of the substrate 1 disappears. Since the height 6a of the resin 6 with which the closed-end hole 4 was filled up by removing the resin protective film 21 is formed in the surface side of the substrate 1, if the substrate 1 is a semiconductor substrate, the height 6a can be made into a vamp as it is, or a vamp can be formed using the height 6a. What is necessary is just to set up the thickness of the resin protective film 21 suitably according to the required length of the height 6a, etc., and it is 10-500 micrometers.

[0046]Attachment of an adhesion film, spreading of a photopolymer and solvent meltable type resin, etc. can perform formation of the resin protective film 21, and exfoliation of an adhesion film, the development of a photopolymer and solvent meltable type resin, etc. can perform removal of the resin protective film 21. Formation of the opening in the resin protective film 21 may be performed by carrying out the mask of the portion corresponding to an opening, when sticking the adhesion film in which it could carry out simultaneously with breakthrough formation of the substrate 1, or the opening was formed beforehand or applying resin.

[0047]As shown in drawing 3 (c), the height 6b of the resin 6 can be formed also in the rear-face side of the substrate 1 by etching the rear-face side of the substrate 1. Thus, when the heights 6a and 6b are formed in the front, back, and both sides of the substrate 1, it is easy to make it flow through each class of the laminated substrate 1, and a multilayer semiconductor package can be obtained by cutting in each unit after this.

[0048]Although the closed-end hole 4 is made into the breakthrough 4a by forming the closed-end hole 4 by sticking the adhesive tape 2 on the rear-face side of the substrate 1 which has a breakthrough in a closed-end hole formation process in each above-mentioned embodiment, and exfoliating the adhesive tape 2 in a through-hole formation process, The formation method of a closed-end hole and a breakthrough is not necessarily limited to the above-mentioned embodiment, and may be made to perform formation of a closed-end hole, and formation of a breakthrough by the formation and removal of a metal skin by the side of the rear face of the substrate 1 which has a breakthrough, respectively, for example.

[Translation done.]

METHOD OF MANUFACTURING RESIN-SEALED SUBSTRATE

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Abstract of **JP2003188308**

PROBLEM TO BE SOLVED: To provide a method by which a resin-sealed substrate having a through hole sufficiently filled up with a sealing resin can be manufactured.
SOLUTION: This method of manufacturing resin-sealed substrate includes a not penetrated hole forming step of forming a not penetrated hole 4 having a closed bottom in the substrate 1, a squeegee operation step (a) of filling up the not penetrated hole 4 with the sealing resin 6 by pushing the resin 6 into the hole 4 while an oversupplied layer 61 of the resin 6 is formed on the substrate 1 in a layer-like shape by operating a squeegee 8 under a vacuum atmosphere, and an air-pressure-difference packing step (b) of packing the resin 6 into the not penetrated hole 4 by pushing part of the oversupplied layer 61 into the hole 4 by using an air pressure difference by raising the pressure in the vacuum atmosphere toward the atmospheric pressure. This method also includes an excessive resin removing step (c) of removing the oversupplied layer 61 left on the surface 1 after the step (b) from the substrate 1 and a through hole forming step (d) of forming the through hole 4a by removing the bottom section of the hole 4. The thickness of the oversupplied layer 61 is set so that the volume decrease of the layer 61 caused by the air-pressure- difference packing may does not exceed the thickness range of the layer 61.
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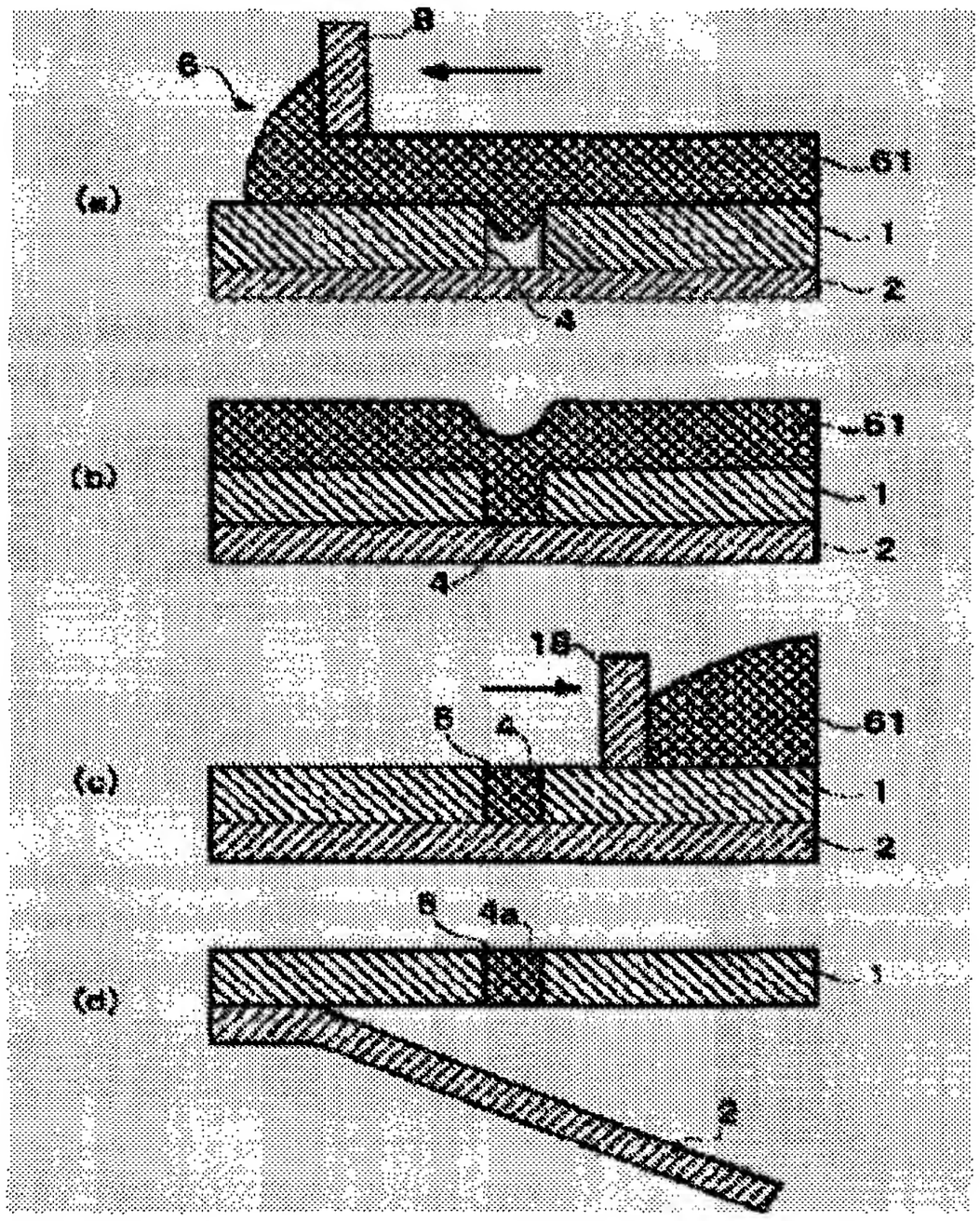

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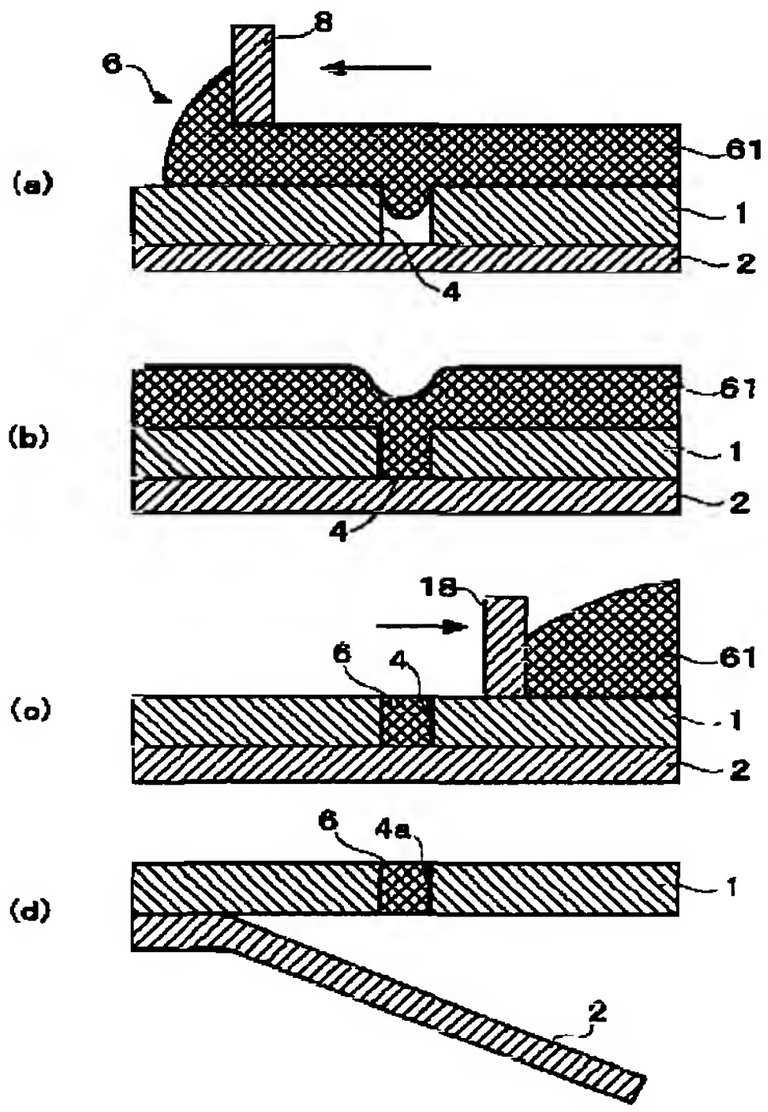
(54)【発明の名称】　樹脂封止基板の製造方法

(57)【要約】
【課題】　基板に形成された貫通孔に封止樹脂が十分に充填された樹脂封止基板の製造方法を提供する。
【解決手段】　下端開口が閉鎖された有底孔４を基板１に形成する有底孔形成工程、真空雰囲気下に於いてスキージ８を作動させて、封止樹脂の過剰供給層６１を基板上に層状に形成しながら、封止樹脂６を有底孔４内に押し込み充填するスキージ作動工程（ａ）、雰囲気圧力を大気圧に向けて上昇させることにより、過剰供給層６１の一部を気圧差により有底孔４内に押し込み充填する気圧差充填工程（ｂ）、気圧差充填工程の後に残存する過剰供給層６１を、基板１上から取り除く余剰樹脂除去工程（ｃ）、及び、有底孔４の底部を除去して貫通孔４ａにする貫通孔形成工程（ｄ）を備え、気圧差充填によって生じる過剰供給層６１の嵩減りが該過剰供給層６１の厚みの範囲内となるように前記厚みを設定することを特徴とする。



【特許請求の範囲】
【請求項１】　基板に形成された貫通孔を樹脂封止してなる樹脂封止基板の製造方法であって、
下端開口が閉鎖された有底孔を基板に形成する有底孔形成工程、
真空雰囲気下に於いてスキージを作動させて、封止樹脂の過剰供給層を基板上に層状に形成しながら、前記封止樹脂を前記有底孔内に押し込み充填するスキージ作動工程、
雰囲気圧力を大気圧に向けて上昇させることにより、前記過剰供給層の一部を気圧差により前記有底孔内に押し込み充填する気圧差充填工程、
前記気圧差充填工程の後に残存する前記過剰供給層を、前記基板上から取り除く余剰樹脂除去工程、及び、
前記有底孔の底部を除去して貫通孔にする貫通孔形成工程を備え、
気圧差充填によって生じる前記過剰供給層の嵩減りが該過剰供給層の厚みの範囲内となるように前記厚みを設定することを特徴とする樹脂封止基板の製造方法。
【請求項２】　前記封止樹脂の粘度は、２３℃において２００Ｐａ・ｓ以下であることを特徴とする請求項１に記載の樹脂封止基板の製造方法。
【請求項３】　基板に形成された貫通孔を樹脂封止してなる樹脂封止基板の製造方法であって、
下端開口が閉鎖された有底孔を基板に形成する有底孔形成工程、
真空雰囲気下に於いてスキージを作動させて、封止樹脂を前記有底孔内に押し込み充填する第１のスキージ作動工程、
雰囲気圧力を上昇させることにより、前記有底孔内の封止樹脂を気圧差により押し込み充填する第１の気圧差充填工程、
雰囲気圧力を低下させて真空雰囲気下に於いてスキージを作動させ、前記第１の気圧差充填工程により生じた前記有底孔の上部空間に封止樹脂を押し込み充填する第２のスキージ作動工程、
雰囲気圧力を上昇させて、前記有底孔内の封止樹脂を気圧差により更に押し込み充填する第２の気圧差充填工程、及び、
前記有底孔内への樹脂充填終了後、前記有底孔の底部を除去して貫通孔にする貫通孔形成工程を備えることを特徴とする樹脂封止基板の製造方法。
【請求項４】　前記貫通孔形成工程を、第２のスキージ作動工程及び第２の気圧差充填工程が複数回繰り返し行われた後に行うことを特徴とする請求項３に記載の樹脂封止基板の製造方法。
【請求項５】　前記封止樹脂の粘度は、２３℃において２００Ｐａ・ｓより大きいことを特徴とする請求項３又は４に記載の樹脂封止基板の製造方法。
【請求項６】　前記第１の気圧差充填工程及び／又は第２の気圧差充填工程における雰囲気圧力の上昇速度は、１０～５０ｋＰａ／分であることを特徴とする請求項３から５のいずれかに記載の樹脂封止基板の製造方法。
【請求項７】　前記第２のスキージ作動工程における雰囲気圧力を、前記第１のスキージ作動工程における雰囲気圧力よりも高く設定することを特徴とする請求項３から６のいずれかに記載の樹脂封止基板の製造方法。
【請求項８】　前記第２のスキージ作動工程における雰囲気圧力を、前記第１のスキージ作動工程における雰囲気圧力と同じか又はそれよりも低く設定し、前記第１の気圧差充填工程の後、前記第２のスキージ作動工程を開始するまでに、所定の時間放置することを特徴とする請求項３から７のいずれかに記載の樹脂封止基板の製造方法。
【請求項９】　前記有底孔形成工程は、前記基板の表面に樹脂保護膜を形成する工程を更に備え、
前記貫通孔形成工程は、前記基板から前記樹脂保護膜を除去する工程を更に備える請求項１から８のいずれかに記載の樹脂封止基板の製造方法。
【請求項１０】　前記貫通孔形成工程は、前記有底孔の底部を除去して貫通孔とした後、前記基板の裏面側をエッチングすることにより、前記貫通孔に充填されている封止樹脂を突出させる工程を更に備える請求項１から９のいずれかに記載の樹脂封止基板の製造方法。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、半導体基板などの基板に形成された貫通孔を樹脂封止してなる樹脂封止基板の製造方法に関する。
【０００２】
【従来の技術】電子機器の小型化や薄型化に伴い、使用される半導体装置の小型化や薄型化が図られている。例えば、ＢＧＡパッケージやＣＳＰのようにインターポーザを介してパッケージされたものや、フリップチップパッケージやウェハレベルパッケージのように素子単位で直接マザーボードに搭載されるパッケージの開発が行われている。
【０００３】このようなパッケージサイズの縮小化は二次元的なレベルでは限界に近づいているため、最近では、平面状に配置されていた複数の素子を立体的に積層することにより、１つのパッケージで複数の機能を省スペースで達成する技術の開発が進められている。積層された各素子の回路間を接続する手法として、ワイヤボンディングによる場合はパッケージサイズの縮小化が図れないため、ワイヤを使用する代わりに半導体基板に貫通孔を形成し、この貫通孔を介して上下の回路を導通させる構成にすることで、パッケージを縮小化する試みが注目されている。
【０００４】半導体基板の表裏を導通させる方法としては、貫通孔の壁面を絶縁して貫通孔内に導電性の樹脂を

充填する方法や、貫通孔の壁面を導電メッキして貫通孔内を放熱用の樹脂で充填する方法が挙げられる。前者の場合には、貫通孔内に樹脂未充填部が存在すると信頼性が低下するため、貫通孔内が樹脂で完全に満たされていなければならない。後者の場合は、貫通孔内に樹脂未充填部が存在しても導通不良の問題は生じないが、素子の駆動に伴う発熱の放散を良好にするために、やはり貫通孔内が樹脂で完全に満たされていることが好ましい。即ち、半導体基板の貫通孔に充填される封止樹脂に対しては、内部に気泡をほとんど含まず、且つ、基板の表面と略面一であることが要求される。

【０００５】

【発明が解決しようとする課題】半導体基板に形成された貫通孔を樹脂封止する方法としては、図４（ａ）に示すように、スキージ５０を基板５２の表面に沿って摺動させて、供給された樹脂５４を貫通孔５６に押し込み充填する方法が一般的である。ところが、半導体基板に形成された貫通孔は、回路パターンが極めて微細であることから微小径であることが要求され、例えば、一般の配線基板においてはスルーホール径が数１００μmであるのに対し、数μm～数１０μmである。このため、単にスキージを作動させて押し込み充填するだけでは、以下のような問題が生じていた。

【０００６】即ち、樹脂の粘度が低い場合には、図４（ｂ）に示すように、貫通孔５６に供給された樹脂が、硬化する前に基板５２の下方からにじみ出てしまい、貫通孔５６の上部開口付近に未充填部５６ａを生じるおそれがあった。尚、このような現象は、常温における粘度が低い樹脂に限られず、硬化時の温度で粘度低下する樹脂の場合においても生じ得る。一方、樹脂の粘度が高い場合には、図４（ｃ）に示すように、貫通孔５６の下部まで樹脂５４を十分に押し込むことが困難であり、貫通孔５６内に未充填部５６ａが存在してしまうという問題があった。

【０００７】また、上述した問題以外に、貫通孔５６に充填される際に巻き込まれた空気が、封止後の樹脂内に気泡として残存するおそれがあるという問題もあった。

【０００８】本発明は、このような問題を解決すべくなされたものであって、基板に形成された貫通孔に封止樹脂が十分に充填された樹脂封止基板の製造方法を提供することを目的とする。

【０００９】

【課題を解決するための手段】本発明の前記目的は、基板に形成された貫通孔を樹脂封止してなる樹脂封止基板の製造方法であって、下端開口が閉鎖された有底孔を基板に形成する有底孔形成工程、真空雰囲気下に於いてスキージを作動させて、封止樹脂の過剰供給層を基板上に層状に形成しながら、前記封止樹脂を前記有底孔内に押し込み充填するスキージ作動工程、雰囲気圧力を大気圧に向けて上昇させることにより、前記過剰供給層の一部を気圧差により前記有底孔内に押し込み充填する気圧差充填工程、前記気圧差充填工程の後に残存する前記過剰供給層を、前記基板上から取り除く余剰樹脂除去工程、及び、前記有底孔の底部を除去して貫通孔にする貫通孔形成工程を備え、気圧差充填によって生じる前記過剰供給層の嵩減りが該過剰供給層の厚みの範囲内となるように前記厚みを設定することを特徴とする樹脂封止基板の製造方法により達成される。

【００１０】この樹脂封止基板の製造方法は、前記封止樹脂の粘度が２３℃において２００Ｐａ・ｓ以下の場合に、特に好適である。

【００１１】また、本発明の前記目的は、基板に形成された貫通孔を樹脂封止してなる樹脂封止基板の製造方法であって、下端開口が閉鎖された有底孔を基板に形成する有底孔形成工程、真空雰囲気下に於いてスキージを作動させて、封止樹脂を前記有底孔内に押し込み充填する第１のスキージ作動工程、雰囲気圧力を上昇させることにより、前記有底孔内の封止樹脂を気圧差により押し込み充填する第１の気圧差充填工程、雰囲気圧力を低下させて真空雰囲気下に於いてスキージを作動させ、前記第１の気圧差充填工程により生じた前記有底孔の上部空間に封止樹脂を押し込み充填する第２のスキージ作動工程、雰囲気圧力を上昇させて、前記有底孔内の封止樹脂を気圧差により更に押し込み充填する第２の気圧差充填工程、及び、前記有底孔内への樹脂充填終了後、前記有底孔の底部を除去して貫通孔にする貫通孔形成工程を備えることを特徴とする樹脂封止基板の製造方法によっても達成される。

【００１２】この樹脂封止基板の製造方法は、必要に応じて、前記貫通孔形成工程を、第２のスキージ作動工程及び第２の気圧差充填工程が複数回繰り返し行われた後に行うことが好ましい。

【００１３】また、前記封止樹脂の粘度が２３℃において２００Ｐａ・ｓより大きい場合に、特に好適である。

【００１４】更に、前記第１の気圧差充填工程及び／又は第２の気圧差充填工程における雰囲気圧力の上昇速度は、１０～５０ｋＰａ／分であることが好ましい。

【００１５】また、前記第２のスキージ作動工程における雰囲気圧力を、前記第１のスキージ作動工程における雰囲気圧力よりも高く設定しても良く、或いは、前記第２のスキージ作動工程における雰囲気圧力を、前記第１のスキージ作動工程における雰囲気圧力と同じか又はそれよりも低く設定し、前記第１の気圧差充填工程の後、前記第２のスキージ作動工程を開始するまでに、所定の時間放置するようにしても良い。

【００１６】樹脂封止基板のこれらの製造方法において、前記有底孔形成工程は、前記基板の表面に樹脂保護膜を形成する工程を更に備えても良く、前記貫通孔形成工程は、前記基板から前記樹脂保護膜を除去する工程を更に備えても良い。

【００１７】更に、前記貫通孔形成工程は、前記有底孔の底部を除去して貫通孔とした後、前記基板の裏面側をエッチングすることにより、前記貫通孔に充填されている封止樹脂を突出させる工程を更に備えても良い。

【００１８】

【発明の実施の形態】以下、本発明の実態形態について添付図面を参照して説明する。

【００１９】（第１の実施形態）図１は、本発明の第１の実施形態に係る樹脂封止基板の製造方法を示す工程図である。

【００２０】まず、図１（ａ）に示すように、基板１の裏面側に易剥離性の粘着性テープ２を貼着して、基板１に形成された貫通孔を有底孔４とした後、基板１の表面に樹脂６を供給して、真空雰囲気下においてスキージ８を作動させる。雰囲気圧力は、０．０１３～２．６７ｋＰａに設定することが好ましく、０．０６７～１．３３ｋＰａに設定することがより好ましい。雰囲気圧力が高すぎる場合には、樹脂に気泡が残存し易くなるだけでなく、後述する気圧差充填の効果を得にくくなる一方、雰囲気圧力が低すぎる場合には、大気圧に復帰させるのに時間がかかり、生産効率が低下する傾向にある。

【００２１】スキージ８は、基板１の表面から所定の高さだけ上方に位置するように高さ調整が行われており、これによって、スキージ８を作動させた際に、基板１の表面に樹脂６の過剰供給層６１が層状に形成される。また、これと同時に、有底孔４には樹脂６が押し込まれる。

【００２２】樹脂６としては、エポキシ樹脂、アクリル樹脂、ポリイミド樹脂、シリコーン樹脂等の熱硬化性樹脂が好適に使用され、低粘度の液状エポキシ樹脂が、価格、作業性、特性面で特に好ましい。また、有底孔４の壁面が絶縁性の場合には、導電性を有することが好ましいが、有底孔４の壁面が金属（銅、ニッケル、金など）でメッキされていて表裏導通がとられている場合は必ずしも導電性は必要でない。但し、導電性が不要な場合であっても、素子の駆動に伴う発熱を放散する目的で、金属粉末（例えば，銅、銀、アルミニウム、金など）を配合した樹脂を用いることが有効である。この場合、熱伝導性を高めることが目的であって、導電性を必要とはしないため３０～７０ｗｔ％程度の配合でよい。勿論、金属粉末の含有量を高めて、導電性を付与することも可能である。

【００２３】また、放熱性を高める目的で、金属粉末を配合する代わりに、熱伝導性の高い充填剤（例えば、シリカ、アルミナ、窒化アルミニウム、窒化ケイ素、窒化ホウ素、その他金属酸化物など）を配合したものも有効である。このような充填材を配合した樹脂６の場合は、樹脂の熱膨張率を低下させて基板（半導体基板）１の熱膨張率に近づけることができるため、信頼性を高められる効果もある。

【００２４】本実施形態で使用する樹脂６の粘度は、２３℃において２００Ｐａ・ｓ以下であることが好ましい。導電性材料や充填剤の配合によって樹脂６の粘度が増大し、作業性を改善する必要がある場合、低粘度の希釈剤を用いることができる。但し、真空下で印刷する条件下では、印刷時の真空度で沸騰、揮発等の組成変化を起こさないような希釈剤を選択する必要がある。例えば、高沸点の溶剤、低粘度のエポキシ樹脂（反応性希釈剤とよばれるモノエポキシ、ジエポキシ化合物）の他、アクリルモノマー、スチレンモノマー、シリコーンカップリング剤、シリコーンオイルなどが希釈剤として好適である。

【００２５】このような真空雰囲気下におけるスキージ作動工程により、図１（ａ）に示すように樹脂６が有底孔４に供給されるが、有底孔４の下部には未充填部１４が存在した状態になる。

【００２６】次に、雰囲気圧力を大気圧に向けて上昇させる。この気圧差充填工程により、未充填部１４と外部雰囲気との間に気圧差が生じ、図１（ｂ）に示すように、過剰供給層６１の一部が未充填部１４に向けて押し込まれ、過剰供給層６１の表面が窪んだ状態になる。

【００２７】この後、図１（ｃ）に示すように、大気圧下において基板１の表面に沿って掻き取り部材１８を摺動又は近接移動させることにより余剰樹脂除去工程を行い、残存する過剰供給層６１を除去すると共に、有底孔４に充填された樹脂の表面を平滑にする。

【００２８】そして、有底孔４内の樹脂を硬化させてから、図１（ｄ）に示すように粘着性テープ２を剥離することにより、有底孔が貫通孔４ａとなり、樹脂封止基板が完成する。

【００２９】このように製造された樹脂封止基板によれば、スキージ作動工程を真空雰囲気下で行うため、有底孔４に供給される樹脂に気泡が残存するのを防ぐことができる。また、有底孔４に供給された樹脂を、気圧差充填工程において更に押し込むことができるため、有底孔４が微小径であっても最深部まで十分な充填が可能である。この気圧差充填工程により、有底孔４内部の樹脂に嵩減りが生じて過剰供給層６１の窪みが形成されるが、この窪み深さよりも大きくなるように過剰供給層６１の厚みを予め設定しておくことにより、有底孔４の内部に十分な量の樹脂を供給することができ、未充填部１４を消滅させることができる。これらの結果、基板に形成された貫通孔に封止樹脂が十分に充填された樹脂封止基板を得ることができる。

【００３０】（第２の実施形態）次に、本発明の第２の実施形態に係る樹脂封止基板の製造方法について、図２に示す工程図に基づき説明する。尚、本実施形態の説明において、第１の実施形態と同様の構成については同一の符号を付している。

【００３１】まず、図２（ａ）に示すように、基板１の

裏面側に易剥離性の粘着性テープ２を貼着して、基板１に形成された貫通孔を有底孔４とした後、基板１の表面側に樹脂６を供給して、真空雰囲気下においてスキージ８を作動させる。雰囲気圧力は、第１の実施形態の場合と同様の理由から、０．０１３～２．６７ｋＰａに設定することが好ましく、０．０６７～１．３３ｋＰａに設定することがより好ましい。

【００３２】スキージ８は、基板１の表面に沿って摺動又は近接移動するように高さ調整が行われている。これにより、有底孔４には樹脂６が押し込まれ、残りの樹脂６はスキージ８の移動と共に掻き取られる。

【００３３】樹脂６としては、第１の実施形態において挙げたものを使用可能であるが、第１の実施形態に係る樹脂封止基板の製造方法は、２３℃における粘度が２０Ｐａ・ｓ以下の比較的低粘度の樹脂を使用する場合に好適であるのに対し、本実施形態に係る製造方法は、使用する樹脂の粘度が２３℃において２００Ｐａ・ｓを超える場合に特に好ましく使用することができる。但し、低粘度の樹脂６を使用する場合でも、本実施形態の製造方法により樹脂封止基板を製造することは可能である。

【００３４】このような真空雰囲気下における第１のスキージ作動工程により、図２（ａ）に示すように樹脂６が有底孔４に供給されるが、有底孔４の下部には未充填部１４が存在した状態になる。

【００３５】次に、雰囲気圧力を大気圧に向けて上昇させる。この第１の気圧差充填工程により、未充填部１４と外部雰囲気との間に気圧差が生じ、図２（ｂ）に示すように、有底部４に供給された樹脂６が最深部まで押し込まれる。これにより、未充填部１４は、有底孔４の上部に移動する。第１の気圧差充填工程における最終的な雰囲気圧力は２．６７ｋＰａ～１０１．３ｋＰａ（大気圧）であることが好ましく、１３．３ｋＰａ～１０１．３ｋＰａ（大気圧）であることがより好ましい。

【００３６】ついで、雰囲気圧力を再び低下させて真空度を高めてから、図２（ｃ）に示すように、基板１の表面に再び樹脂６を供給して真空雰囲気下においてスキージ８を作動させ、第２のスキージ作動工程を行う。この時の雰囲気圧力は、第１のスキージ作動工程における雰囲気圧力と同じ範囲に設定することが好ましい。これにより、未充填部１４に樹脂６が供給される。

【００３７】この後、雰囲気圧力を大気圧に向けて再び上昇させて、第２の気圧差充填工程を行う。これにより、図２（ｄ）に示すように、第２のスキージ作動工程で有底孔４に供給された樹脂６が押し込まれる。第２の気圧差充填工程における最終的な雰囲気圧力についても、第１の気圧差充填工程における雰囲気圧力と同じ範囲に設定することが好ましい。

【００３８】第２の気圧差充填工程を行った後も、有底孔４に供給された樹脂６の上部に窪みが見られる場合には、この窪みが実質的に問題とならない大きさに縮小されるまで、上述した第２のスキージ作動工程及び第２の気圧差充填工程を繰り返し行うことが好ましい。この繰り返し回数は、有底孔４の径や深さ、或いは樹脂６の粘度などを考慮して、適宜設定することが可能である。

【００３９】有底孔４への樹脂充填を終えた後は、第１の実施形態と同様に、有底孔４内の樹脂６を硬化させてから粘着性テープ２を剥離することにより、有底孔４が貫通孔となり、樹脂封止基板が完成する。

【００４０】このように製造された樹脂封止基板によれば、第１及び第２のスキージ作動工程を真空雰囲気下で行うため、有底孔４に供給される樹脂に気泡が残存するのを防ぐことができる。また、第１のスキージ作動工程で有底孔４に供給した樹脂６を第１の気圧差充填工程により押し込んでから、更に、第２のスキージ作動工程で有底孔４に供給した樹脂６を第２の気圧差充填工程により押し込むようにしているので、粘度の高い樹脂６であっても未充填部１４を残存させることなく有底孔４に供給することができる。これらの結果、基板に形成された貫通孔に封止樹脂が十分に充填された樹脂封止基板を得ることができる。

【００４１】第１及び第２の気圧差充填工程において、雰囲気圧力を上昇させる際の圧力上昇速度は、１０～５０ｋＰａ／分に設定することが好ましい。圧力上昇が急激すぎると、有底孔４に供給されていた樹脂６が急速に押し込まれるため、最深部まで押し込まれた樹脂６に未充填部が残存し易くなる一方、圧力上昇が緩やかすぎると、生産効率が低下する傾向にあるためである。

【００４２】また、生産効率を向上させる観点からは、第２のスキージ作動工程における雰囲気圧力を、第１のスキージ作動工程における雰囲気圧力よりも高く（即ち、真空度を低く）設定することが好ましい。第２のスキージ作動工程において要求される樹脂６の押し込み量は、第１のスキージ作動工程において要求される押し込み量よりも小さいため、雰囲気圧力をこのように設定しても有底孔４に樹脂６を十分に押し込むことができる。このような設定により、第２のスキージ作動工程に要する時間を短縮化することができ、更に、第１の気圧差充填工程により有底孔４に供給された樹脂６から実用上問題とならない程度の微細な気泡が発生するおそれがなく、有底孔４における樹脂形状の安定化を図ることができる。尚、第２のスキージ作動工程を繰り返し行う場合には、後工程ほど雰囲気圧力が高くなるように設定すれば良い。

【００４３】これに対し、樹脂封止の信頼性を高める観点からは、第２のスキージ作動工程における雰囲気圧力を、第１のスキージ作動工程における雰囲気圧力と同じかこれよりも低く（即ち、真空度を高く）設定することが好ましい。これにより、第１の気圧差充填工程で有底孔４に押し込まれた樹脂６に気泡が残存している場合であっても脱泡が可能になり、より完全な封止樹脂の充填

を行うことができる。このような脱泡をより確実に行うためには、第１の気圧差充填工程の後、第２のスキージ作動工程を開始する前に、所定時間（例えば１～１０分）放置しておくことが好ましい。尚、第２のスキージ作動工程を繰り返し行う場合には、それぞれの雰囲気圧力を同じに設定するか、或いは、後工程ほど雰囲気圧力が低くなるように設定すれば良い。

【００４４】（その他の実施形態）以上、本発明の一実施形態について詳述したが、本発明の具体的な態様が上記実施形態に限定されるものではない。例えば、上記各実施形態において、有底孔４に供給された熱硬化性の樹脂６を硬化させる際に、雰囲気圧力を大気圧以上の圧力（例えば、０．１～５ＭＰａ）にして、所定の温度（例えば、６０～２００℃）で１０～１２０分程度加熱することにより、樹脂６を短時間で硬化させて工程の短縮化を図ることができる。

【００４５】また、上記各実施形態において、基板１に樹脂６を供給する前に、図３（ａ）に示すように、基板１の表面に予め樹脂保護膜２１を形成しても良い。この樹脂保護膜２１は、基板１の貫通孔に対応する部分に開口が形成されており、有底孔４への樹脂供給終了後または有底孔４内の樹脂硬化後、図３（ｂ）に示すように、樹脂保護膜２１を除去することにより、供給した封止用の樹脂６が基板１の表面に残存するおそれがなくなる。また、樹脂保護膜２１を除去することにより、有底孔４に充填された樹脂６の突起部６ａが基板１の表面側に形成されるので、基板１が半導体基板であれば、突起部６ａをそのままバンプとしたり、或いは、突起部６ａを利用してバンプを形成したりすることができる。樹脂保護膜２１の厚みは、突起部６ａの必要長さなどに応じて適宜設定すれば良く、例えば１０～５００μｍである。

【００４６】樹脂保護膜２１の形成は、粘着フィルムの貼着や、感光性樹脂・溶剤可溶型樹脂の塗布などにより行うことができ、樹脂保護膜２１の除去は、粘着フィルムの剥離や、感光性樹脂・溶剤可溶型樹脂の現像などにより行うことができる。また、樹脂保護膜２１における開口の形成は、基板１の貫通孔形成と同時に行っても良く、或いは、予め開口の形成された粘着フィルムを貼着したり、樹脂を塗布する際に開口に対応する部分をマスクする等して行っても良い。

【００４７】更に、図３（ｃ）に示すように、基板１の裏面側をエッチングすることにより、基板１の裏面側にも樹脂６の突起部６ｂを形成することができる。このように、基板１の表裏両側に突起部６ａ，６ｂを形成した場合には、積層した基板１の各層を導通させることが容易であり、この後、個々の単位に切断することにより、多層半導体パッケージを得ることができる。

【００４８】また、上記各実施形態においては、有底孔形成工程において、貫通孔を有する基板１の裏面側に粘着性テープ２を貼着することにより有底孔４を形成し、貫通孔形成工程において、粘着性テープ２を剥離することにより、有底孔４を貫通孔４ａとしているが、有底孔及び貫通孔の形成方法は、必ずしも上記実施形態に限定されるものではなく、例えば、貫通孔を有する基板１の裏面側へのメッキ層の形成及び除去により、有底孔の形成及び貫通孔の形成をそれぞれ行うようにしても良い。

【００４９】

【実施例】実施例として、厚さが１５０μｍの基板に直径が５０μｍの貫通孔を形成し、この貫通孔の裏面側を粘着性テープで塞いで有底孔としてから、２３℃における粘度が１００Ｐａ・ｓである樹脂を用いて、真空印刷装置により上記第１の実施形態と同様の手順で樹脂封止基板を製造したところ、貫通孔の内部に樹脂が略完全に充填された樹脂封止基板を得ることができた。また、使用する樹脂の粘度が２３℃において３００Ｐａ・ｓである他は同じ条件により、上記第２の実施形態と同様の手順で樹脂封止基板を製造したところ、やはり貫通孔の内部に樹脂が略完全に充填された樹脂封止基板を得ることができた。尚、樹脂の粘度測定には、トキメック（株）製のＢ－Ｈ型回転粘度計を使用した。

【００５０】

【発明の効果】以上の説明から明らかなように、本発明によれば、基板に形成された貫通孔に封止樹脂が十分に充填された樹脂封止基板を製造することができる。

【図面の簡単な説明】

【図１】　本発明の第１の実施形態に係る樹脂封止基板の製造方法を示す工程図である。

【図２】　本発明の第２の実施形態に係る樹脂封止基板の製造方法を示す工程図である。

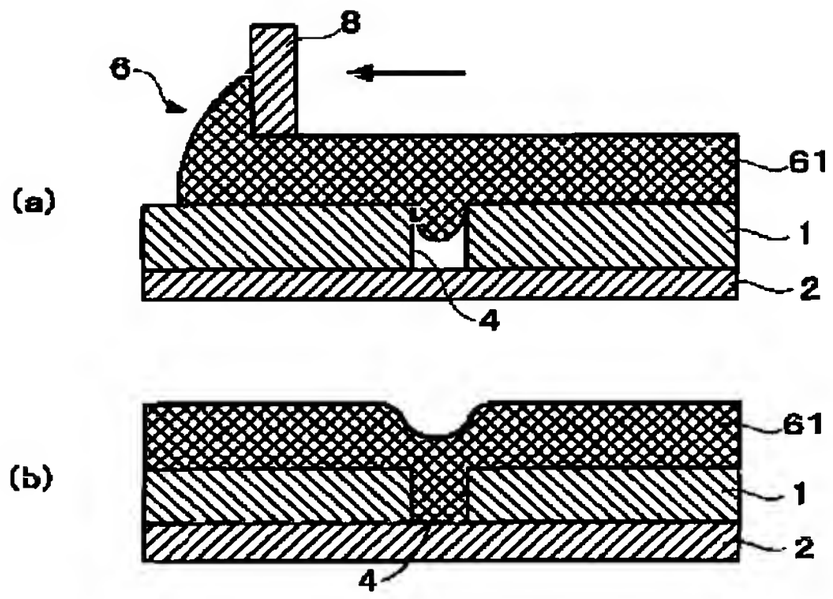
【図３】　本発明の他の実施形態に係る樹脂封止基板の製造方法を示す工程図である。

【図４】　従来の樹脂封止基板の製造方法を示す工程図である。

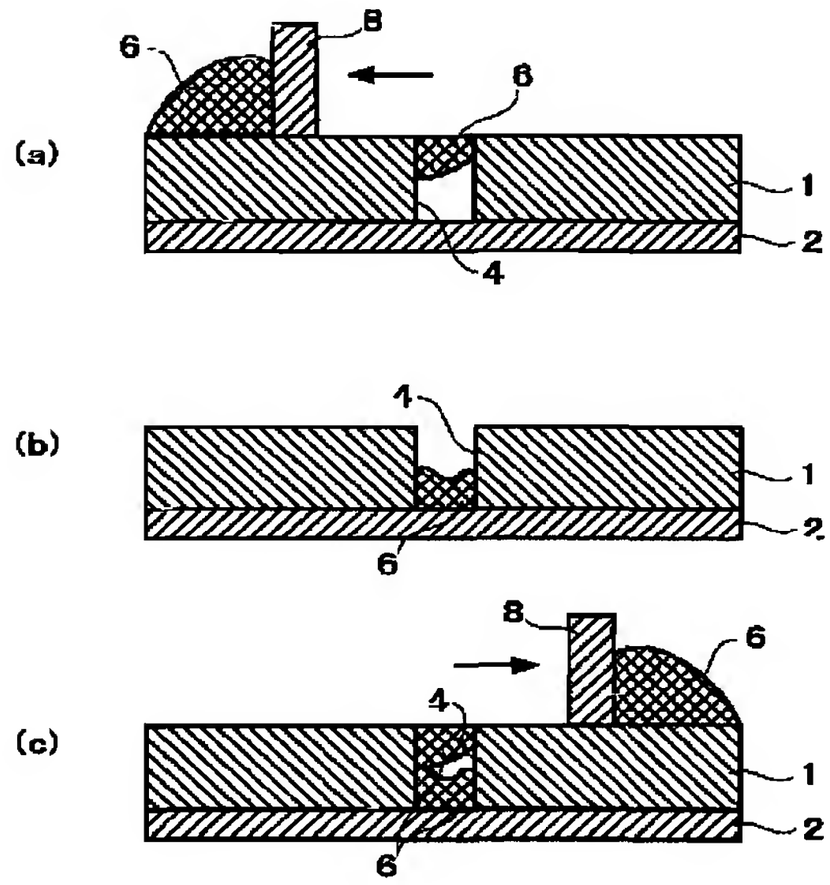
【符号の説明】

１　基板
２　粘着性テープ
４　有底孔
４ａ　貫通孔
６　樹脂
６ａ，６ｂ　突起部
８　スキージ
２１　樹脂保護膜
６１　過剰供給層

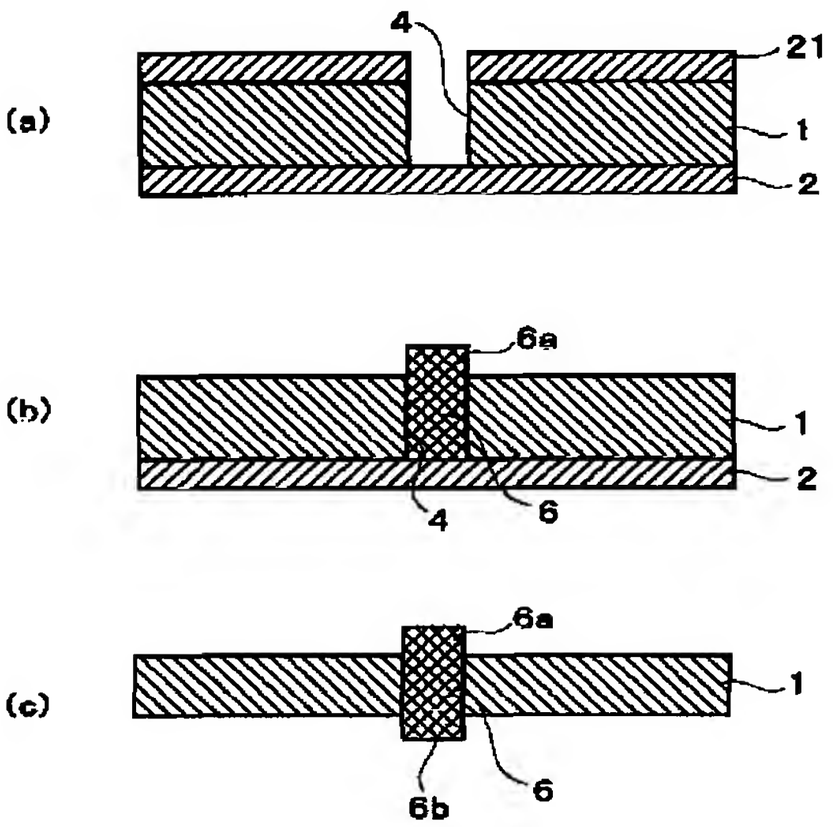
【図1】


(a)
8
6
61
1
2
4
(b)
61
1
2
4

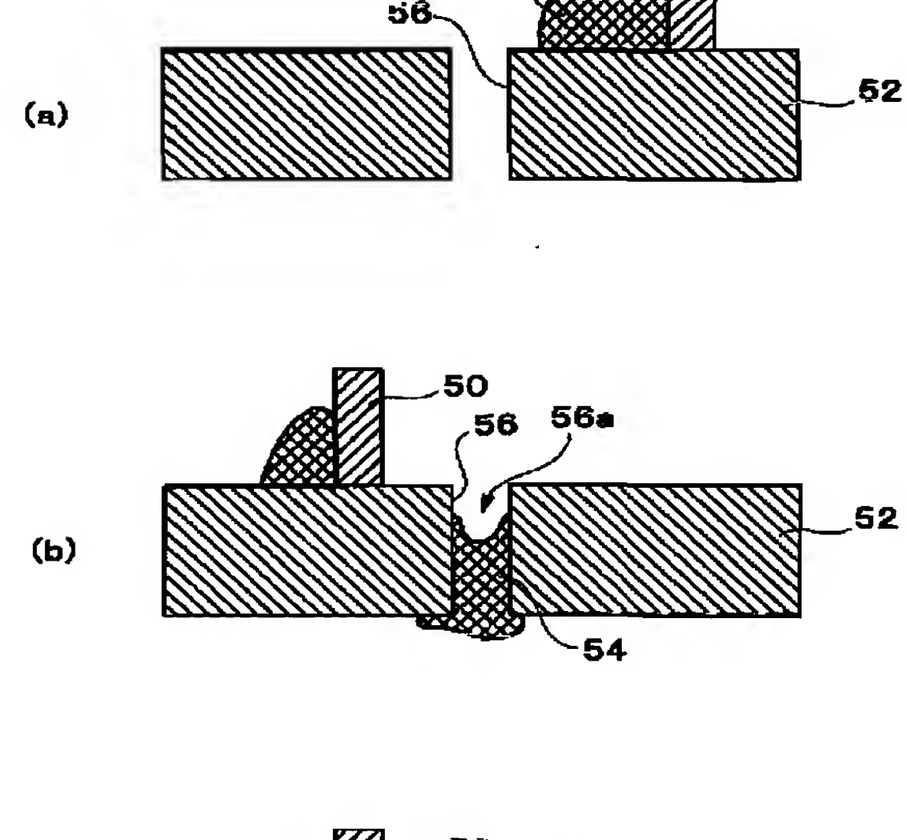
【図2】


(a)
6
8
6
1
2
4
(b)
4
1
2
6
(c)
8
6
4
1
2
6
(d)
4
1
2
6

【図3】


(a)
4
21
1
2
(b)
6a
1
2
4
6
(c)
6a
1
6b
6

【図4】


(a)
54
50
56
52
(b)
50
56
56a
52
54
(c)
50
54
52
56a
56

フロントページの続き

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